INTERNATIONAL APPLIED SCIENCE AND TECHNOLOGY ASSOCIATES (IASTA,INC.)
A. H. Rubenstein, President • 1801 E. Jefferson St. #620 • Rockville, MD 20852
Phone: (301) 881-9376 • Fax: (301) 881-1571 • E-mail: a-rubenstein@northwestern.edu

Fax to: Elizabeth "E. R." Anderson Dept. of Commerce 5 /9 /07
(202) 482-2889 6PP
From: A.. H. Rubenstein, president of IASTA, Inc.
This is in response to the request for comments on the Committee category on " 3. Identification of firm-specific data items that could enable comparisons and aggregation." (IASTA is a consulting business.)

DESCRIPTION OF PROPOSAL.

1. Innovative projects and programs in the firm should be visualized as a series of stages in the overall R&D/Innovation or Lab-to-Market process. The attached examples, from our dozens of studies of R&D indicators and metrics over the past three decades, illustrate such stages in the form of flow diagrams.
2. These related, but quasi-discrete stages are typically performed by different individuals or groups within the firm, (and outside the firm when outsourcing is used and when the results approach the market or application (e.g. in the factory) stage.
3. The stages and their particular outputs or impacts are subject to different constraints or barriers (Bs)to flow, stemming from the different cultures of the participating groups, as well as the overall environment in the company and the market – e.g. a monopolistic vs. a highly competitive market or a "new" vs. an "old" market.
4. In addition, potentially effective facilitators(Fs) to the flow of innovations vary with the differing cultures and environments to which the process is subjected from Idea to Market or Application. These Barriers and Facilitators reflect the environment of the innovation process and the progress of individual projects and programs. Examples of such differences include: "get it out the door quick and dirty", "send nothing out that does not reflect the highest

INTERNATIONAL APPLIED SCIENCE AND TECHNOLOGY ASSOCIATES (IASTA,INC.)
A. H. Rubenstein, President • 1801 E. Jefferson St. #620 • Rockville, MD 20852
Phone: (301) 881-9376 • Fax: (301) 881-1571 • E-mail: a-rubenstein@northwestern.edu

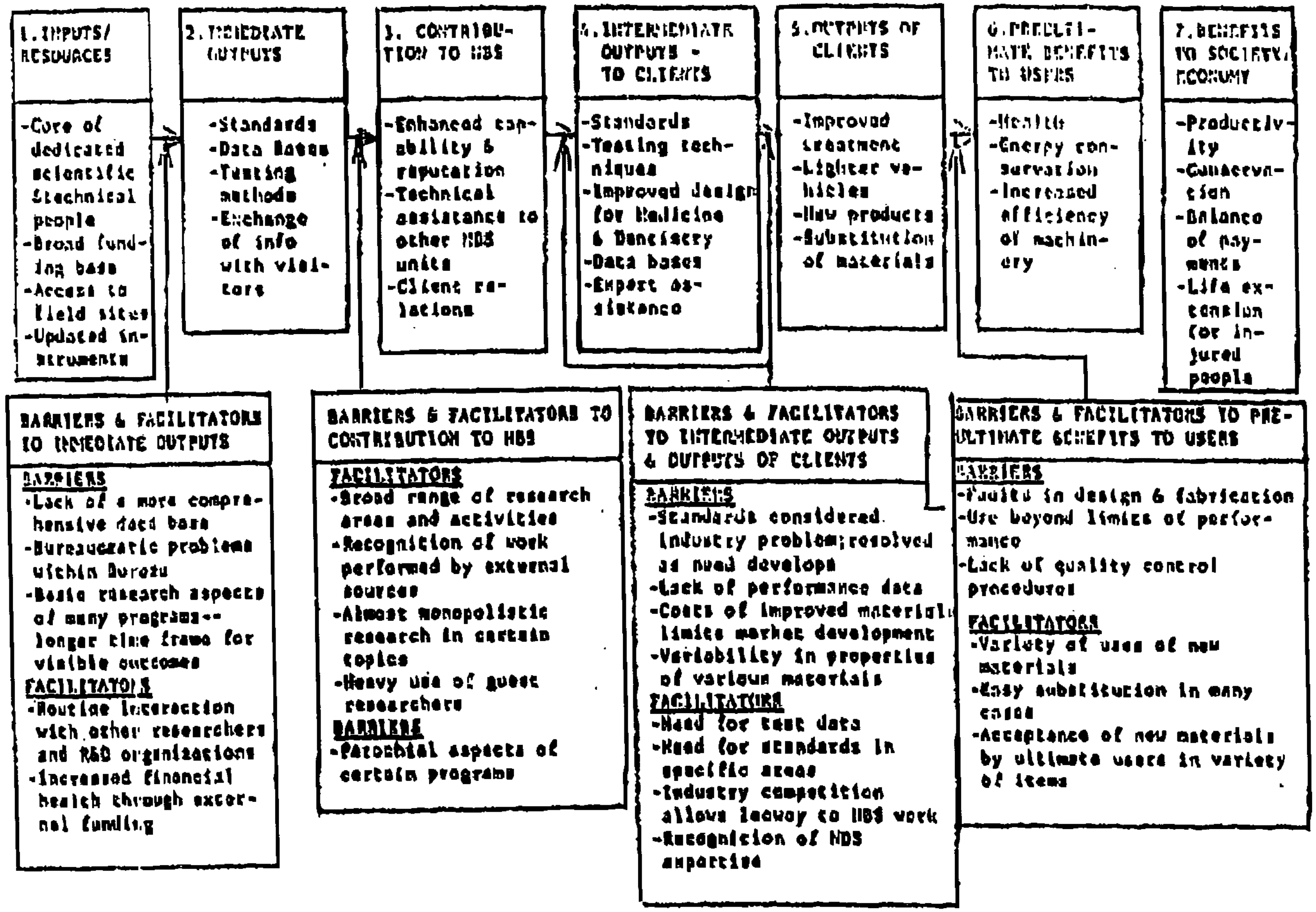
technical and quality standards", "meet the competition, but don't take risks beyond theirs."

5. The three entities included in the process flow diagrams – a) outputs or impacts, b) barriers, and c) facilitators have to be converted to "indictors" in operational terms and "metrics" in quantitative terms or qualitative terms in the forms of attributes – e.g. satisfactory/unsatisfactory; significant/less significant;/ not significant; high/medium/low, etc.
6. Examples from the attached flow diagram for Polymer Science and Standards (taken from a study we did for the National Bureau of Standards (NIST) in Stage 4 are: PROGRESS/IMPACTS: Improved design for medicine and dentistry. Metric: how much improvement in effectiveness and cost
BARRIERS: Variability in properties of various materials. Metric: Variability in a particular material is no problem/ some problem/ unacceptable for use
FACILITATORS: Availability of test data and standards in specific area. Metrics: Degree of availability and ease of access.
7. The data collection should be part of the regular process of monitoring and managing the project or program. There should be very little extra cost if this analysis is performed by project members or managers. For example, of the several dozen flow diagrams we have constructed in various organizations, most of them required approximately 2 hours of the time of knowledgeable people. Initial operationalizing (developing indicators and metrics) for a given project takes less than a day; subsequent fine tuning can take an hour or two.

INTERNATIONAL APPLIED SCIENCE AND TECHNOLOGY ASSOCIATES (IASTA, INC.)
A. H. Rubenstein, President • 1801 E. Jefferson St. #620 • Rockville, MD 20852
Phone: (301) [illegible] • Fax: (301) [illegible] northwestern.edu

8. The proposed approach can have significant positive effects on the R&D/Innovation process within the firm. It identifies key elements that can improve the overall process and management of individual projects and programs. It provides a basis for better measures of progress on R&D/Innovation projects and the factors (barriers and facilitators) that affect their progress and ultimate success and the actions needed to improve the process and the outcomes of individual projects or programs.
9. Results of the more than a dozen studies performed by IASTA in this field have been reported in the open literature and in client reports by Albert H. Rubenstein and Eliezer Geisler.

Figure 1 Flow model for polymer science and standards



We present here two examples of R&D institutes in the areas of: (1) electrical energy, and (2) powder metallurgy.

The electrical energy R&D was conducted by a research institute which had five basic objectives: (1) to integrate the institute into the national electric power sectors; (2) to establish specialized R&D laboratories; (3) to support main enterprises in the electrical sector; (4) to develop and train human resources; and (5) to integrate the institute into the scientific community. The flow model for this institute is given in Figure 3.

The powder metallurgy laboratory was a division of a larger technology institute. The division's main objective was to develop technologies which will allow local industries to reduce their dependence on foreign know-how, thus to contribute to savings in foreign exchange. Figure 4 shows the flow model for the powder metallurgy laboratory.

4.4 *Evaluation of military R&D laboratories*

The purpose of our study was to develop a set of indicators of the productivity of R&D, tailored to military laboratories, to help management assess and monitor the innovative

Figure 3 Flow model for electrical energy R&D

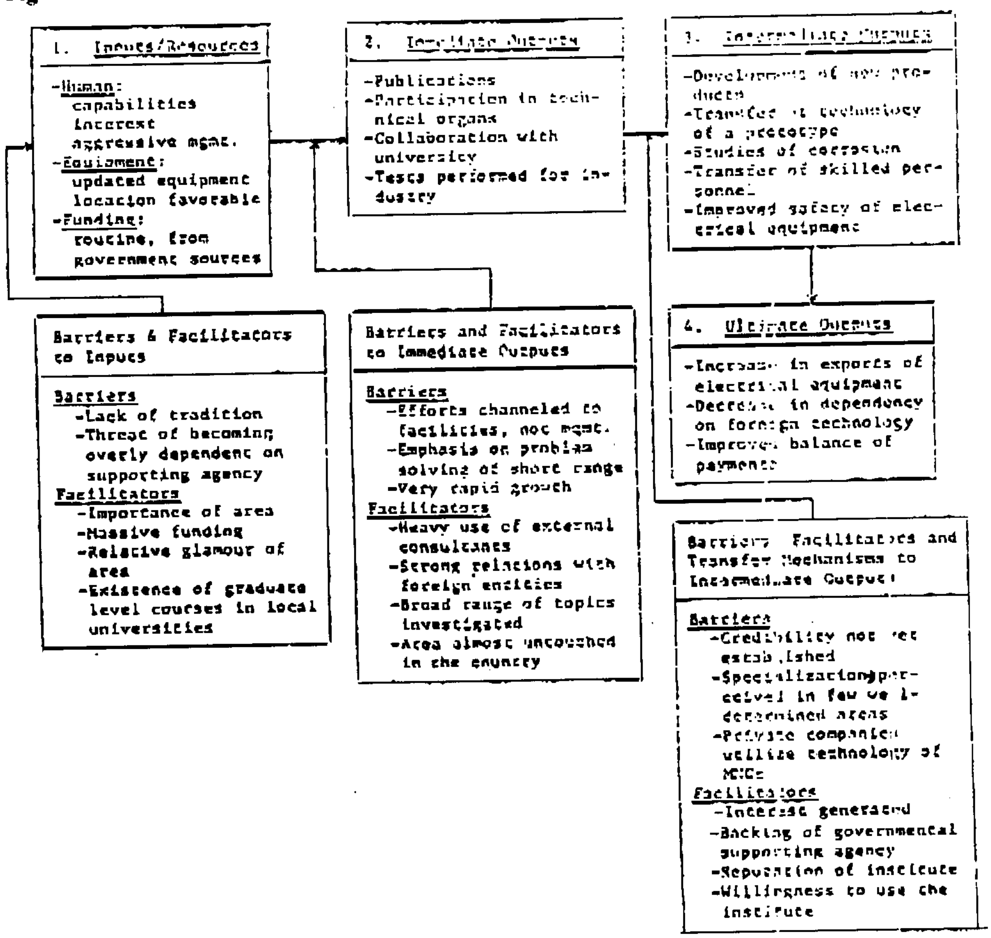
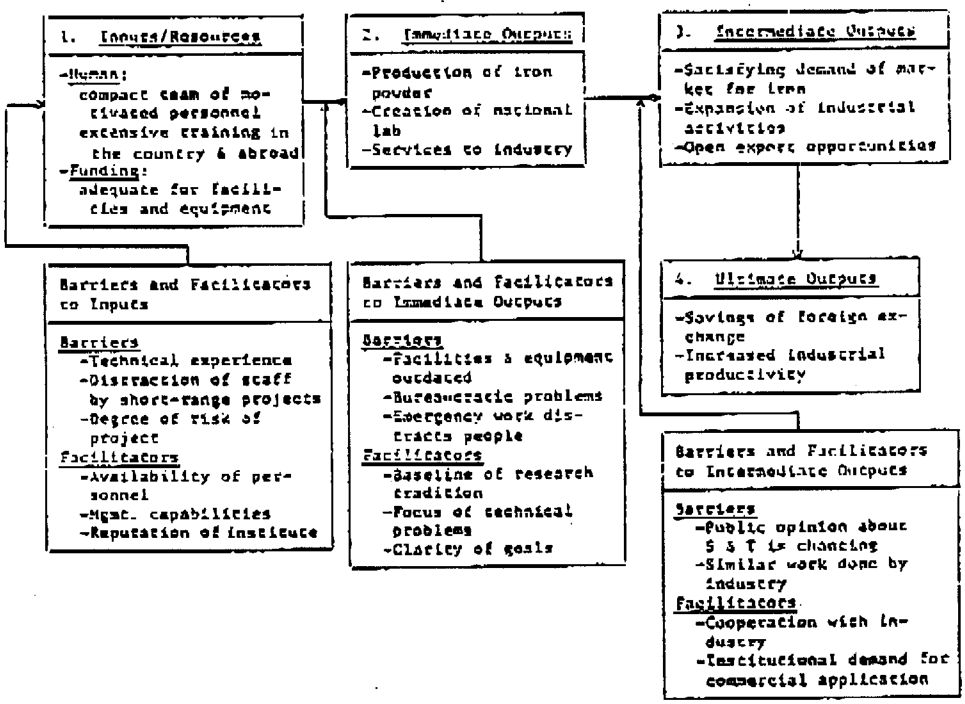


Figure 4 Flow model for powder metallurgy R&D



and technical capabilities of each laboratory. In addition to the methodology described in this article, we also conducted a survey of eight industrial R&D organizations. We sent questionnaires to their R&D managers. Responses were received from seven managers. The survey was designed to elicit a qualitative rating of the military R&D laboratories, as compared with university, industrial and other Federal labs in the same or related fields.

The military laboratories we studied were entrusted with developing, testing and implementing technology for several support branches of the military establishment. Their areas of research were food technology, heat stress, and materials sciences.

Figure 5 shows the flow model for the military R&D laboratories in the area of food technology.

5 Some methodological issues/problems

The 'indicators' methodology described in this paper is an empirical procedure carried out in the field. Typically, access is not easy to obtain unless the study is part of a consulting contract which requires the personnel in the subject organization to cooperate. Even then, care must be taken to obtain the agreement of informants (describers of the RDI activities of the organization and prime sources of the indicators for the flow models) to cooperate and to go beyond grudging participation in the exercise. To date, we have been gratified by the enthusiastic and creative inputs by most of the people in the organizations we have studied. The challenge of identifying indicators for their project/program and that of others